11. (Twice Amended) The process according to claim 5, wherein the poly(meth)acrylates are worked into the contaminated soil up to a depth of about 50 cm.

13. (Amended) A process for reducing the presence of heavy metals in plants growing in soil contaminated with heavy metals, comprising: applying to the contaminated soil a heavy metal reducing effective amount of a compound selected from the group consisting of cross-linked polyacrylates and polymethacrylates.

16. (Amended) The process according to claim 7, wherein the cross-linking agent is methylenebisacrylamide.

18. (Amended) The process according to claim 9, wherein the monoethylenically unsaturated monocarboxylic acids are neutralized between 50 and 90 mol percent.

19. (Amended) The process according to claim 10, wherein the absorption capacity is more than 50 g/g of the poly(meth)acrylates.

20. (Amended) The process according to claim 10, wherein the absorporption capacity is more than 65 g/g of the poly(meth)acrylates.

REMARKS

Claims 2-11, 13-16, and 18-20 are pending in the present application. Claims 1 and 12 have been cancelled. Claim 17 is also cancelled in the present amendment.

Claims 2-11 and 13-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, this rejection relates to certain typographical error and improper form of recitation. Amendments to the claims have been made in the present

response. It is respectfully requested that the rejection under 35 U. S. C. 112, second paragraph, be withdrawn.

Claims 2-11 and 13-20 are further rejected under 35 U.S.C. 103(a) as being unpatentable over Vyshkina '965 in view of EP 0072214 and further in view of EP 0072213. Specifically, Vyshkina '965 discloses the application of high molecular weight polyacrylamide in removing heavy metals, particularly chromium. EP 0072213 teaches polyacrylamide as a polyacrylate. EP 0072214 discloses a process for making crosslinked polyacrylamide. The water retention and desirable level of water soluble materials are also described in this reference. The Examiner stated that one of ordinary skilled in the art would have been motivated to use the polyacrylamide of EP 0072214 for the purpose taught by Vyshkina '965. The Examiner, therefore, concluded claims 2-11 and 13-20 are rendered obvious by these references.

We respectfully traverse the Examiner's rejection. Vyshkina '965 relates to a method for treating solid wastes such as soil etc. contaminated with heavy metals by the application of high molecular weight polyacrylamide. According to the specification, this method can entrap such heavy metal impurities in the form of non-toxic stable solid material usable for backfilling, road construction subbase, landfill closing-up etc. (column 1, lines 5-16). To realize this object, a solution of anionic synthetic organic flocculant is used for washing a sludge of the contaminated soil at pH 9-12, followed by other steps including separating the liquid and solid phases of the washed soil sludge and further treating the liquid phase with an alkaline reagent etc. (see column 3, lines 14-36 and column 6, claim 1). The anionic organic flocculant can be polyacrylamide (see column 8, claim 9 and 14). A typical process according to the description comprises: crushing the heavy contaminated soil in mill; sifting the soil to 100 mesh; conveying the soil to a reactor; washing the soil in the reactor etc. See column 4, lines 25-40.

Both EP 0072213 and EP 0072214 relate to water retentive polymeric compositions useful as plant growing media additives.

In contrast, the present invention is directed to a process for reducing the plant availability of heavy metals. Specifically, the process comprises applying to the contaminated soil a heavy metal reducing effective amount of a compound selected from the group consisting of cross-linked polyacrylates and polymethacrylates (see claim 1). It was surprisingly found that when cross-linked poly(meth)acrylates are added to substrates contaminated with heavy metals, the plant availability of heavy metals is distinctly reduced or even completely eliminated. This effect remains active over a long period of time, surprisingly as long as many months.

Since these references cited by the Examiner address different problems from the present invention, we believe there is no motivation for an artisan skilled in the art to combine these references to make the present invention. Specifically, Vyshkina '965 is directed to a method for treating soil by washing the soil with solution of anionic synthetic organic flocculant. The present invention is directed to a method of reducing the plant availability of heavy metals, which treats the soil substrate of the plants by means of mixing cross-linked polyacrylates or polymethacrylates. Thus, Vyshkina '965 employs the solution of anionic synthetic organic flocculant such as polyacrylamide to solve a different problem from the present invention, which relates to protecting the plant by applying cross-linked polyacrylates or polymethacrylates to the soil around the plant. The other two patents EP 0072213 and EP 0072214 provide growing medium for plants comprising a polymeric composition together with an aqueous plant nutrient solution. This is in contrast to the present invention which endeavors to prevent the plant from taking in any heavy metals in the soil.

Further, even if a skilled artisan combine these references, he could not make the present invention. He may use the cross-linked polyacrylates to wash the contaminated soil at pH 9-12 at most, which is obviously not the present invention which reduces the heavy metal availability to the plant for as long as many months.

Accordingly, it is respectfully requested that the rejection of claims 2-11 and 13-20 under 35 U.S.C. 103(a) as being unpatentable over Vyshkina '965 in view of EP 0072214 and further in view of EP 0072213 be withdrawn.

Additionally, we note that the Examiner cited U.S. Patent 5,405,425 of Pieh et al. as considered pertinent to applicant's disclosure. The Pieh patent describes a method that directly teaches away from the presently claimed invention. The Pieh patent teaches a method of conditioning the soil to increase its capacity to retain water or aqueous solutions containing plant nutrients. The method comprises adding to the soil crosslinked copolymers based on acrylamide or methacrylamide (col. 1, lines 6-11). According to the Pieh patent, the copolymers are particularly advantageously used when the copolymers contain plant nutrients. Preferably, these nutrients are "from . . . iron, zinc, copper, manganese, molybdenum . . . salts." (col. 2, lines 50-56). It is possible to load the copolymer again and again with the nutrient containing solution in further loading cycles after the nutrients have been taken up by the roots (col. 2, line 66 - col. 3, line 5). Thus, the Pieh patent teaches that many metal salts cannot be permanently retained by the copolymers when the copolymers are added to the soil. As further support, Example 6 shows a number of different copolymers that are added to the soil do not retain polyvalent cations upon the irrigation of the soil with salt water (see especially, copolymers CA, polyacrylamide/acrylic acid; CB, polyacrylic acid polymer; and CC, polyacrylamide). Thus, one of ordinary skill in the art

would not have used crosslinked copolymers of acrylamide to solve the problem of reducing the availability of heavy metals as presently claimed.

Accordingly, it is respectfully submitted that the pending claims are all in a condition for allowance, early notice of which is earnestly requested.

It is believed that no fees or charges are required at this time in connection with the present application; however, if any fees or charges are required at this time, they may be charged to our Patent and Trademark Office Deposit Account No. 03-2412.

Respectfully submitted,
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AMENDMENTS TO THE CLAIMS SHOWING CHANGES

IN THE CLAIMS:

2. (Twice Amended) The process according to claim 13[12], wherein the soil is treated by mixing the compound into the soil.

5. (Twice Amended) The process according to claim 13[12], wherein the cross-linked poly(meth)acrylates are produced by [using] a method comprising polymerizing monoethylenically unsaturated monocarboxylic acids.

6. (Twice Amended) The process according to claim 13[12], wherein the poly(meth)acrylates are produced by [using] a method comprising polymerizing monoethylenically unsaturated monomers containing no carboxylate groups.

7. (Twice Amended) The process according to claim 5, wherein the poly(meth)acrylates are [obtained] cross linked by a cross-linking agent selected from a group consisting of [using] methylenbis(meth)acrylamide, ethylenbis(meth)acrylamide, N-methylolacrylamide or triallylamin and combinations thereof [as cross-linking agents].

8. (Twice Amended) The process according to claim 5, wherein the poly(meth)acrylates are treated with a subsequent cross-linking agent in quantities of 0.01 to 10% by weight, at [an increased] a temperature between 80 and 250 °C. Supp pg 4

9. (Twice Amended) The process according to claim 5, wherein [the acidic monomer components of the poly(meth)acrylate] monoethylenically unsaturated monocarboxylic acids are neutralized between 10 and 95 mol percent.

10. (Twice Amended) The process according to claim 5, wherein the poly(meth)acrylates have an absorption capacity for synthetic soil solution of more than 30 g/g of the poly(meth)acrylates.

11. (Twice Amended) The process according to claim 5, wherein the poly(meth)acrylates are worked into the contaminated [acid] soil up to a depth of about 50 cm.

13. (Amended) A process for reducing the presence of heavy metals in plants growing in soil contaminated with heavy metals, comprising: applying to the contaminated soil a heavy metal reducing effective amount of a compound selected from the group consisting of cross-linked polyacrylates and polymethacrylates [polymethylacrylates].

16. (Amended) The process according to claim 7, wherein the cross-linking agent is [poly(meth)acrylates are obtained by using] methylenebisacrylamide [methylenebisacylamide].

18. (Amended) The process according to claim 9, wherein the [acidic monomer components] monoethylenically unsaturated monocarboxylic acids are neutralized between 50 and 90 mol percent.

19. (Amended) The process according to claim 10, wherein the absorption capacity is more than 50 g/g of the poly(meth)acrylates.

20 (Amended) The process according to claim 10, wherein the absorporption capacity is more than 65 g/g of the poly(meth)acrylates.